1.0 WHAT IS A HIGH-SPEED TRAIN SYSTEM?

1.1 Existing High-Speed Train Systems

High-speed rail is a form of rail transport in which trains are electrically propelled at speeds exceeding 150 miles per hour. These trains currently operate in regular revenue service at maximum speeds of about 190 miles per hour, but

have been tested at over 320 miles per hour. At high speeds, trains must be completely grade-separated, meaning there are no at-grade crossings with roads or other types of transportation; the tracks are fenced to prevent intrusion; and the trains must run on new, dedicated alignments that are very straight. High-speed trains also must have sophisticated, modern signaling and automated train control systems. High-speed trains are a safe, efficient, reliable and pleasurable way to travel between destinations that are generally between 100 to 500 miles apart. Utilizing a fraction of the energy per passenger of automobiles and jets, high-speed trains are the safest mode, with no fatalities ever registered on new infrastructure designed for high speeds. Where they serve heavily traveled corridors, high-speed train passenger revenues generally exceed operational and maintenance costs.

Presently, two high-speed train technologies exist in the world: steel-wheel-on-steel-rail systems and magnetic levitation (Maglev) systems. The Japanese Shinkansen, or "bullet" train, the French TGV and the German ICE are all examples of steel-wheel-on-steel-rail systems. These are high-tech train systems that vastly improve upon traditional passenger rail technology. High-speed steel-wheel-on-steel-rail systems have been extensively proven in revenue service, carrying over five billion passengers to date.

High-Speed Trains in Japan and Asia

The Shinkansen was first introduced in revenue service in Japan in the mid-1960s with a 343-mile line connecting Tokyo and Osaka. Today, the Shinkansen network totals over 1,150 miles connecting Japan's major metropolitan areas and carries over 300 million passengers every year. While operating hundreds of high-speed trains each day, the Japanese have a perfect safety record and near perfect on-time performance with an average deviation from schedule of only 24 seconds. Other Asian nations are now pursuing high-speed systems of their own. A new high-speed rail system is under construction in Korea and another is set to begin construction in Taiwan.

High-Speed Trains in Europe

High-speed train service began in France in 1981 and in Germany in 1991, although planning for the lines began in the late 1960s and early 1970s. In Europe, high-speed trains operate not only over specially engineered high-speed lines, but also at reduced speeds over improved "conventional" rail lines used by other rail services as well. Thus, the reach of the high-speed service is far greater than

the length of the new high-speed lines. In France, the TGV network began with the construction of a 186-mile high-speed segment that served an improved rail network of 550 miles. Today, the TGV network consists of over 800 miles of new interconnected high-speed lines and operate on a total network of nearly 3,500 miles of improved rail carrying over 45 million passengers every year. High-speed trains now operate through and connect England, France, Belgium, Germany, Italy and Spain. Ultimately, there will be a fully integrated high-speed train network throughout Europe.

Magnetic Levitation Systems (Maglev)

Maglev systems are a completely new technology that departs from the wheel-rail system by using either attractive or repulsive magnetic forces to lift and propel the vehicles along a guideway. Because Maglev trains hover above a guideway, these systems create no friction or rolling resistance and are expected to travel at even higher speeds than steel-wheel-on-rail systems. There are no high-speed Maglev systems operating in revenue service anywhere in the world. However, both Germany and Japan have been developing and testing Maglev prototypes on test facilities for many years and are planning revenue producing Maglev systems that could begin construction later in this decade.

Higher Speed Train Service in the United States

In the United States, Amtrak's Metroliner service between New York City and Washington, D.C. is the only rail service that approaches high-speed standards. Currently, the Metroliner trains make the 226-mile trip in less than three hours traveling at speeds up to 125 mph. A large improvement project to electrify and upgrade service from New York City to Boston is nearly complete. Newly developed trains capable of traveling up to 150 mph and fully compatible with the existing services will begin operating between Boston and Washington, D.C. in the year 2000. Amtrak expects the new trains, called Acela, to greatly increase the profitability of the service.

High-speed trains have operated in Europe and Japan for decades.

1.2 High-Speed Trains for California

The decision to choose a particular type of high-speed technology for California should be deferred until after the environmental clearance phase of this project. Manufacturers of steel-wheel-on-rail and Maglev technologies should be able to compete for the opportunity to use their technology in California, ensuring the best product for the best price.

Regardless of technology, high-speed trains will offer Californians a new way of traveling. Combining the benefits of moving from one part of the state to another quickly with the freedom to plug in your computer or talk on a cell phone or get up to get a cup of coffee, high-speed train travel promises Californians a relaxing, productive trip. Tables would be available for group seating, with conference rooms available for business meetings en route. Because they travel over new dedicated infrastructure, trains traveling at high speeds provide an extremely safe, smooth and comfortable ride — seat belts are never needed. And high-speed trains are the most reliable way to travel, not hampered by rain, fog or interstate freeway delays in completing their scheduled runs.

Design Standards for California

In this draft business plan, high-speed trains are defined as those capable of exceeding 200 miles per hour. These trains will not operate at those speeds everywhere in the state. Indeed, within the state's urban regions, high-speed trains will likely only travel at maximum speeds between 100 and 150 miles per hour. For purposes of this business plan, all other trains — equipment, service, and trackage — will be known as "conventional rail."

The high-speed infrastructure will be a state-of-the-art, proven, world-class technology that significantly increases the state's transportation capacity. The system will use electric propulsion on a double track or guideway to provide the necessary high capacity, flexibility, and reliability. The system will be completely grade separated, with no potential for conflict with pedestrian or vehicular traffic. In addition, the high-speed train right-of-way will be completely fenced and monitored to avoid intrusion by pedestrians, wildlife or livestock. Using modern signaling technology, trains on similar infrastructure in Asia and Europe can operate at three-minute intervals.

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In general, the high-speed train system will be built at-grade and require a corridor 50 feet wide *(see Figure 1.1)*. In severely constrained urban areas, where grade separation costs are prohibitive, aerial structures *(Figure 1.2)* or retained fill are assumed. By comparison, a 12-lane freeway constructed to Caltrans standards requires a nearly 225-foot wide right-of-way.

All intermediate stations will feature siding tracks to allow express trains to pass through without slowing down. High-level boarding platforms will facilitate passenger loading and unloading as well as meet requirements for disabled passengers under the Americans with Disabilities Act. Each station will be a transportation hub connecting the high-speed train system to highways, conventional rail, transit, and/or air transportation networks, as appropriate.

The ridership and revenue estimates in this plan have assumed 10-car trains capable of seating 650 passengers, and that by 2020 the system will need to operate trains about every 15 minutes during peak periods. To put the total available capacity of this system into perspective, consider that the signaling system would permit trains to run every three minutes, and additional passenger cars could be added to the trainsets. Two trainsets could even be linked — effectively doubling their capacity. Trains carrying 650 passengers every three minutes in both directions could serve up to 26,000 passengers per hour — equivalent to the number of passengers currently moved on a 12-lane urban freeway during peak periods. The Authority's projections suggest that even by 2050, the high-speed system would be carrying less than 50 percent of its ultimate potential capacity. The high-speed train infrastructure would provide capacity to serve California's growing transportation and mobility needs to move intercity passengers, commuters, and goods throughout the twenty-second century.

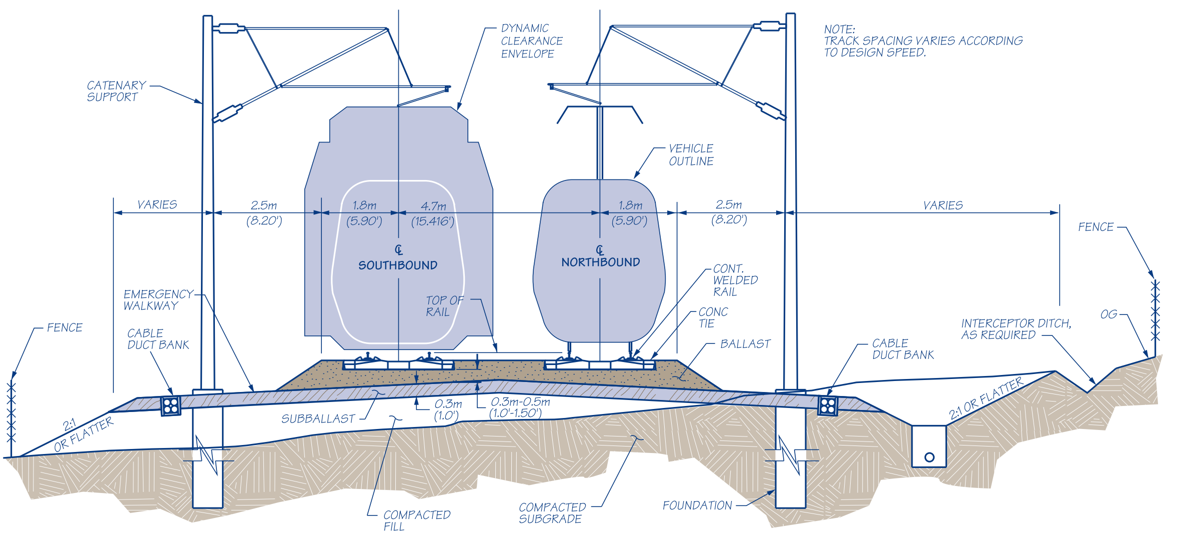

Figure 1.1
At-Grade Ballasted Trackway

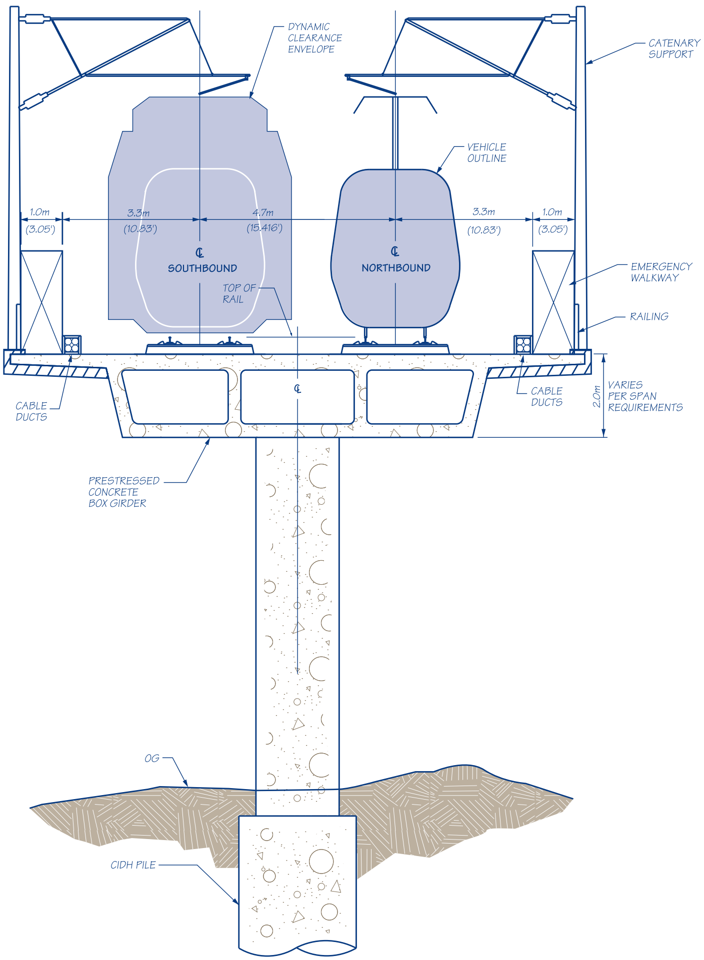

Figure 1.2
Aerial Trackway

Compatibility with Other Rail Services

The Authority has assumed that the dual track or guideway is dedicated exclusively to high-speed and compatible rail services. Presently, high-speed trains capable of speeds exceeding 200 miles per hour cannot share track or guideway with conventional rail operations, including the current generation of passenger equipment operated by Amtrak and regional rail authorities, as well as the freight equipment currently operated by the freight railroads. Where high-speed and conventional rail operations must share a right-of-way, the incompatible services must be separated horizontally or vertically. The high-speed tracks or guideway will be protected by an intrusion detection system and, in some areas, separated from conventional rail operations by a crash barrier, or by placing the high-speed trains on an aerial structure.

Federal Railroad Administration (FRA) rules do not allow for mixed operations of high-speed and conventional rail equipment, primarily because the two classes of equipment are designed to withstand different impact loads in the event of a collision. Because conventional rail equipment is much heavier and impact-resistant, the possibility of collision with a lighter high-speed trainset poses a potential safety hazard. The FRA may eventually adopt rules consistent with European practice that rely on collision avoidance rather than traffic separation. It is also possible that a high-speed trainset meeting both crashworthiness and high-speed performance specifications will be available during the implementation time frame of this project.